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some older Asiatic types, which came probably by way of the Philippine islands. Younger Asiatic immigrants arrived in Celebes by way of Java, and the smaller Sunda islands, but not directly from Borneo, the old Strait of Makassar separating it from this island, which also received immigrants from the Philippines, and sent others in turn to them, from whence they were able to find their way to Celebes.

"In addition, the fauna of Celebes received Australian types from the Moluccas, where they were in part relicts, in part later immigrants from Australia. Possibly also the smaller Sunda islands received a few immigrants from this latter continent."

A. E. O.

BOTANY.

Influence of Light and Darkness on growth and Development.[1] — In this work is presented one of the most important, if not the most important, single piece of research in plant physiology yet published in this country. It is a record of a series of extensive experiments covering several years (1895–1902), from which important generalizations have been drawn. Heretofore too much of the general principles laid down regarding the influence of light upon plants has been based upon experiments with a comparatively limited number of forms. It was the author's intention to avoid these errors and for this reason he selected representative plants covering a wide field in both relationship and form. No fewer than ninety-seven forms were experimented with, and etiolated for an often long period of time. These forms include very diverse orders of plants and comprise practically every form of the plant body of importance. Various typical and modified forms of stems, including those of succulents and xerophytes, the different types of foliar organs and various floral structures were investigated. A very careful and detailed account of the histology of the different etiolated tissues, in comparison with the normal, is also included.

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[1] MacDougal, D. T. The influence of Light and Darkness upon Growth and Development. *Memoirs New York Botanical Garden.* vol. ii. Jan. 20, 1903, pp. i–xiii,—1–319, 176 figures.

As might be expected such an exhaustive investigation of the relations of plants to light and darkness, leads to new and interesting conceptions as to the action of illumination in determining the growth of the shoots of plants. It is in this of course that the chief interest of the work centers. As a record of careful and interesting observations the first and major part of the work is of great value, but without entering too greatly into detail, it is impossible to give a fair idea of its contents. For that the paper itself had best be consulted. In passing, the following plants, unusual at least from the standpoint of etiolation experiments, may be mentioned, *Amorphophallus rivierii* Dur., *Bowiea volubilis* Harv., *Cocos nucifera* L., *Ibervillea sonoræ* Grev.— and two sarracenias.

In discussing the theories, hitherto presented, the author points out how inadequate and unsatisfactory the explanations of etiolation phenomena have been. Under the heading "Morphogenic Influences of Light and Darkness" the author expresses his own understanding of the problem by a careful analysis of the facts, and the following is intended to give the substance of his discussion.

Etiolation is not to be regarded as an adaptive modification on the part of the plant, and the form that it assumes in darkness is not due to an effort to reach the light. The various phenomena of etiolation are of course, in the first instance, due to the absence of light, but it is only in some cases that a beneficial modification results. Aside from the absence of chlorophyll, the basal fact connected with the condition of etiolated organs is that their tissues do not show the same degree of morphological differentiation as do those of the normal. This lack of differentiation, and the abnormal increase in size which accompanies it, is most noticeable in the large parenchymatous tracts of tissue. An incomplete deposition of aplastic material allows of a much longer growth period. In this connection the author points out that in organs where extension is possible by the formation of additional parenchymatic cells we have the familiar elongation and enlargement of etiolation, whereas in cases like those of dorsiventral leaves, where the mechanical elements are prerequisite for the expansion of the lamina, the organ remains small. A comparison of normal and etiolated plants shows that growth and differentiation are not only independent phenomena, but are easily separable.

From this point of view then the phenomena of etiolation rests upon the absence of the morphogenetic influence of light, or rather as the author modifies it in considering the effect of continuous illumination in producing partially elongated forms, we may suppose that the alternate action of light and darkness constitutes the stimulus which finds expression in tissue differentiation. As is pointed out we can very well imagine in the case of continuous illumination, that the plant having adapted itself to this condition ceases to respond so readily to the stimulating action of light. It may be narrowed down then to the fact that it is light which acts as the stimulating influence in inducing morphological differentiation and in its absence the tissues tend to remain in a more or less primitive condition. The action of light, however, is not necessarily direct, since the stimulative influence may be received by one portion of the body and transmitted to another, as is shown by local aetiolation. The author speaks of the enlargement of certain dorsiventral leaves brought about in etiolated plants by the removal of concurrent organs and mentions that even in their enlarged condition they do not show much tissue differentiation, but he hardly explains the reason for this behavior. Possibly this might be regarded as a reaction to the untoward stimulus of wounding.

The total amount of growth or increase in volume, that may be accomplished by the shoot in the expansion of its imperfectly developed tissues during etiolation, is subject to great variation. In many cases the total length, diameter, and volume may be actually less than in a normally grown plant, and indeed the rate of growth need not be so rapid. It may be said that light does not directly affect the rate of growth, that it does not exert the retarding or paratonic influence commonly ascribed to it. This is shown by the action of plants exposed to continuous illumination.

It will be seen that this is an important addition to our knowledge of the influence of light on the growing shoot. Never before has this point of view received such a comprehensive treatment or been supported by such a wealth of facts. The author's insistence that etiolation is not an adaptive reaction and the stress laid upon the anatomical conditions presented by etiolated organs, leads to a far clearer understanding of the actual influence of light as a morphogenetic stimulus. In this latter regard the evidence afforded is especially convincing. It is not yet clear of course why light should so affect tissues as to practically shorten the period of their meristematic condition and to induce the formation of what is usually termed "permanent" tissue. It is said that the aplastic material is not so readily laid down in the absence of light, a statement which suggests a chemical explanation. The exact nature of the chemical changes which are supposed to take place in the differentiation of the usual forms of tissue, must of necessity remain obscure for a long time to come.

In conclusion the very copious index should be mentioned, in which the novel and withal convenient practice has been adopted of entering author's names with a full bibliography.

H. M. R.

A Popular Introduction to Forestry. — Professor Filibert Roth, formerly of Cornell University, and now, as chief of the Division of Forestry, U. S. Department of the Interior, in charge of the work in the Government Forest Reserves, has just published "A First Book of Forestry."[1] The little volume is intended for use in the public schools and in country homes, and gives in non-technical language, an exceptionally clear and readable account of some of the significant aspects of forest life and growth, the most important principles underlying the practice of forestry, and the methods now employed in such common forestry processes as thinning the wood-lot; seeding for succession; sowing cleared areas; harvesting the wood crop; protecting the forest from fire, insects and fungus pests; and so on. He makes clear the forester's aim so to harvest each wood crop as to speed its successor, and discusses the six principal methods of accomplishing this. Following these accounts of forest life and forest reproduction and the description of the ways in which forests should be protected and helped to make their best growth, he also tells us some of the indirect benefits of forests, such as the protection of soil and conservation of moisture, and gives us a brief description of our own forests, and a history of forest culture from the times of the Romans. Then the structural features and physical and chemical properties of wood are taken up; and finally, a key is added for the determination of our common trees by characters of leaf, wood and bark, and the several valuable appendices in addition to more technical tables include a convenient reference list of the more important woods and trees of the United States. The illustrations, which are excellent in themselves and admirably related to the text, add greatly to the latter's value. As a popular educator calculated to render more intelligent the growing sentiment in favor of forest protection, this little book should have a wide circle of readers, and its usefulness will hardly be less because of the considerable number of other good books recently published by our American foresters.

J. S. P.

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[1] Roth, Filibert. *First Book of Forestry.* Boston. Ginn and Co., 1902. 12mo., 291 pp., illus.